Crawford Generating Plant (CGP)

"Preliminary" Exhaust Stack Reduction Submission

Crawford Generating Plant

6 June 2019

1.0 Overview

JEI/MTS has been requested to produce a submission and reduction recommendation for the reduction of the main exhaust stack at the Crawford Generating Plant (CGP), Chicago, IL. As such, this submission presents multiple approaches that have been discussed or considered and the possible benefits or detriments of each. The submission is not intended to be all-inclusive of possible considerations but approaches the necessary task of exhaust stack reduction as a component of site demolition containing a variety of possible impacts from the activity.

2.0 Evaluation Introduction and Design Considerations

The evaluation of any form of demoltion requires consideration of the structure to be reduced, its location, potential impacts, integrity and possible methodologies for the actual work to be performed. The following sections detail a variety of the considerations already considered during the evaluation process.

2.1 Types of Potential Demolition Approaches

There are three or four primary types of potential reduction approaches that could be considered for utilization on the exhaust stack. Each of these contains their own positive or negative attributes, but all are presented as having been considered:

Deconstruction: The act of reduction through inverted construction. This allows the stack to be demolished slowly from the top down, inversionally from method of original construction.

Segmental Demolition: The act of reducing the stack in vertical segments, smaller than the whole. This approach would reduce the stack in segments, which could be accomplished over a period of hours, days or weeks, from the top down.

Whole Structure Reduction: This approach provides for reducing the stack in one piece, at one time.

2.2 Auxiliary Considerations for Demolition

Apart from the actual methodologies employed for stack reduction, the activity of the reduction includes a wide variety of considerations that must also be considered in the evaluation of any methodology for potential utilization. Among these are:

- **Permitting for the activity:** any demolition/reduction activity will necessarily require permitting. Particularly one that involves a structure of the exhaust stack proportions (approximately 388' in elevation).

- **Timing and Duration:** the actual physical timing (regarding weather) of the activity and duration necessary to reduce the structure.
- **Cost:** the economic affect of the approach and resultant impact on the project.
- **Demolition impact:** the mass and weight of the structure will cause significant potential seismic movement and the resulting possible affects on surrounding structures or installations.
- **Directional requirements:** CGP is surrounded by commercial structures and critical infrastructure installations. The directional requirement for reduction (whole) is a decisive component of reduction approach.
- **Safety and Security:** there are multiple tiers of requirements for evaluation of safety and security concerning this specific demolition activity. They include but are not limited to the potential affects on: general area residents; transiting public; demolition workers; and emergency response personnel.
- **Structural Constraints:** The original design and construction of the stack will limit possible methodologies for reduction.
- **Current Condition:** Since the structure is aged, and its current condition is to some degree degraded from original construction, the amount and type of that degradation affects and possibly limits the approaches possible for reduction.
- **Environmental Constraints:** any method of reduction will contain potential environmental impacts (e.g., noise, dust, debris, potential contamination, etc.). Each of these must be considered in developing the reduction approach.
- **Timing:** The actual timing selected to accomplish the work - day of the week, hour of performance, etc.
- **Residual Constraints:** Depending upon the approach for reduction, there will be potential impacts to surrounding traffic, local populace, and general public response.

2.3 Evaluation Process

The evaluation process utilized for a methodology recommedation in the exhaust stack reduction was generated considering each of the above criteria and other components that are somewhat less tangible but potentially influential.

Table 1 (following page) contains a basic matrix of evaluation for each potential methodolgy examined. Much of the information included in the matrix has been the result of data or information collection on a local basis. Definitive information concerning possible alternatives may exist but be unknown to JEI/MTS at this time. For that reason, alone, this report is considered to be preliminary. Subsequent to evaluation by other regulatory or institutional authorities, the recommendation or conclusions contained herein may be marginally or significantly modified.

The evaluation components contained in the matrix represent contained information presetned as relative to the other methodologies and not necessarily as independent, unrelated topics. The informational evaluation for each is contained in Section 3.

Table 1: Evaluation of Criteria for by Methodology					
Component		**Deconstruction**	**Segmental**	**Whole Structure**	
				Mechanical	**Explosive**
Permitting		No known restrictions	Possible restrictions	Possible restrictions	Known restrictions
Timing		Restricted by temperature and precipitation	Restricted by precipitation	No restrictions	Restricted by Precipitation
Duration		Months	Multiple Weeks	1-2 Weeks	1 Week
Cost		Extensive (most costly)	Multiple Events (third costly)	Single Event (least costly)	Single Event (second costly)
Demolition Impact		None known	Varying dependent upon size of segments	Potentially Large	Potentially Large
Safety		High Risk	High Risk	Low Risk	Moderat Risk
Security		Low Risk	Moderate Risk	High Risk	Very High Risk
Structural		High Risk	High Risk	Low Risk	Low Risk
Condition		Somewhat Degraded (high impact)	Somewhat Degraded (some impact)	No Impact	No Impact
Environmental	**Noise**	No Impact	Moderate Impact	High Impact	High Impact
	Dust	No Impact	Moderate Impact	High Impact	High Impact
	Debris	No Impact	Moderate Impact	Moderate Impact	High Impact
Timing		No Impact	Moderate Impact	High Impact	High Impact
Residual	Traffic	No Impact	Limited Impact	Limited Impact	
	Populace	No Impact	Limited Impact	Limited Impact	High Impact
	Public	No Impact	Limited Impact	Unknown	Unknown

2.4 Evaluation Results

Of the evaluated technologies for reduction, two of the approaches have been unilaterally excluded by overwhelming single issues.

2.4.1 Explosive Whole Reduction: The inability to secure the necessary permitting in a timely manner has precluded consideration of this approach as a viable alternative.

2.4.2 Deconstruction: The threat to human health and safety from the number of personnel and duration of the work while working aloft, along with the extensive time and cost involved have precluded consideration of this approach, barring regulatory acceptance of the selected alternative.

2.4.3 Segmental Reduction: While many of the components of evaluation would recommend this approach, threat to human health and safety (of those conducting the work aloft) combined with the unknown structural integrity and potential degredation of the structure (that cannot be sufficiently defined to guarantee safety or success) combine to limit recommendation and consideration of this approach.

2.4.4 Whole Structure Mechanical: This approach contains a variety of higher risk and potentially significant impacts but each of these can be reduced or minimized through adequate preparation and planning. Moreover, this approach contains the ability to limit the duration of the affects of the work and signficantly reduce the potential for hazardous working condition for those involved.

3.0 Whole Structural Mechanical Evaluation

3.1 Permitting

Permitting for this activity is considered feasible. The permitting process, undertaken by MCM, will determine the timing and a variety of regulatory constraints concerning the actual activity. Each of these has been considered and included below. Other, different or more stringent requirements may be added to the final proposal for activity performance.

3.2 Timing

Weather will play a critical role, but since the process of demolition is controlled and forecasts can be evaluated for a day when the optimal weather conditions (e.g., wind, precipitation, etc.), the adverse impact will be minimal to non-existant.

3.3 Duration

Duration, once begun, will take from one week to 10 days, depending solely upon the desired date (timing) for weather and timing for potential impact to surrounding areas. It is believed that the work will involve only a modest workforce for preparation that has flexibility for application and thereby, extensive control. The critical phase will take approximately three days and, up to that point, structural integrity of the stack will remain sufficiently intact to allow forecasting for other elements to dictate final reduction effort.

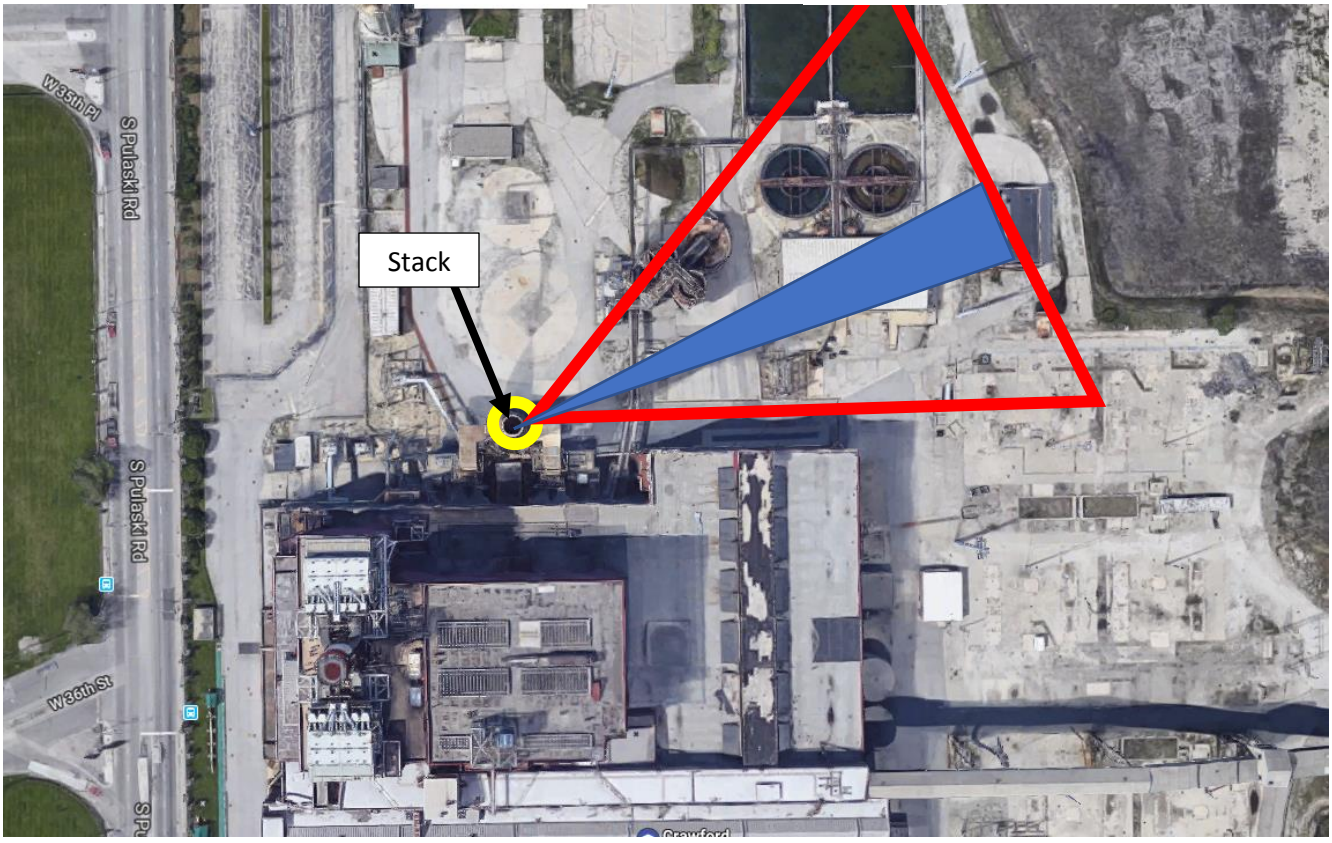
3.4 Cost

The cost of the approach is the most modest of all reduction techniques considered. It is limited to the crew of cutters for rebar and support material within the walls of the stack and the mechanical utilization for directionalization. Potential costs range at less than $100,000.00 for the physical demolition. The stack break-down, after physical reduction, is not included in this estimate.

3.5 Demolition Impact

The physical impact of the structure will have a potential affect on surrounding infrastructure. However, that impact can be evaluated prior to the act, through an evaluation of the impact area and ideal footprint. Figure 1, below, shows the range and the ideal proposed impact area of the stack.

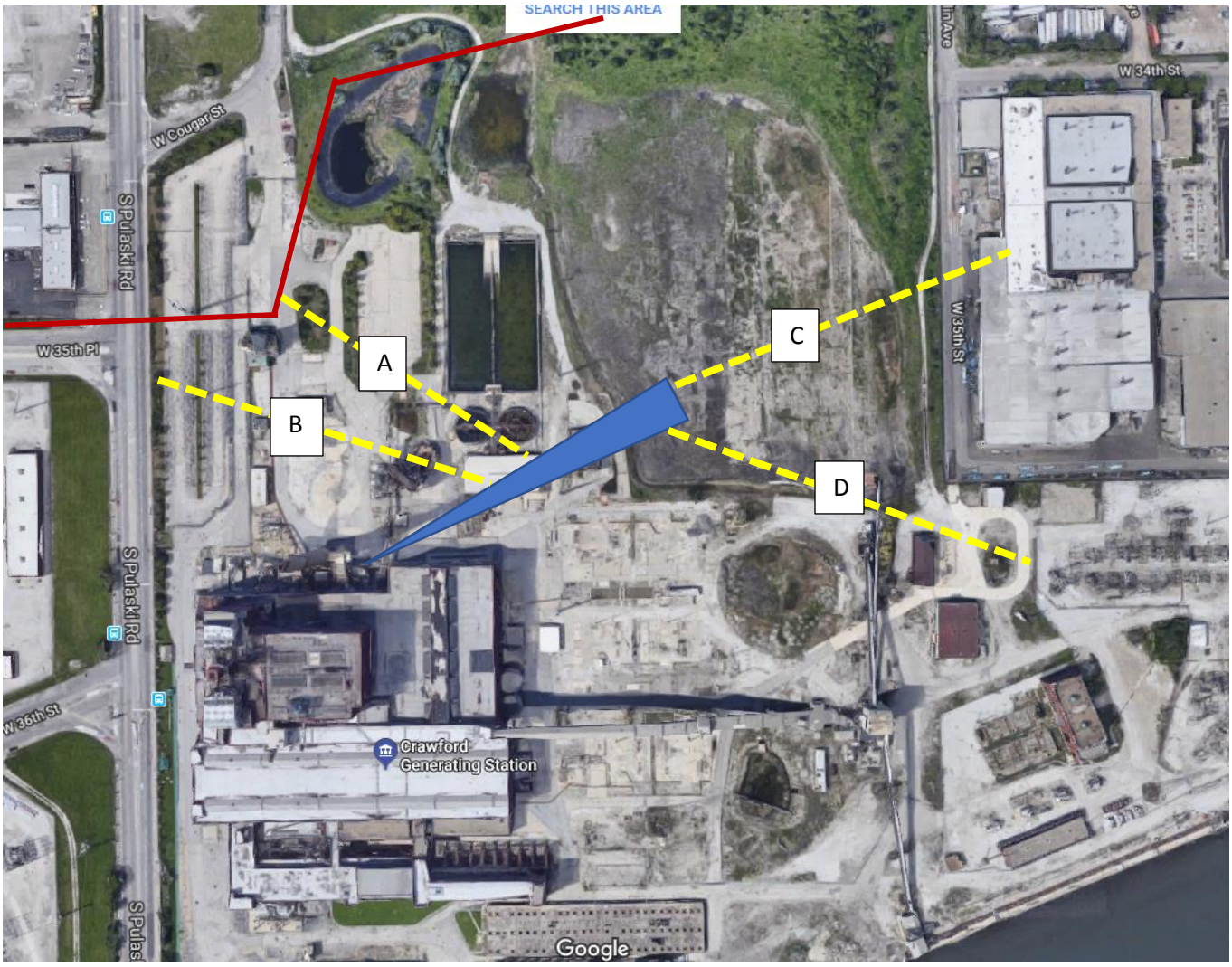
Figure 1: Range of Possible Impacts and Ideal Footprint



The stack will have the relief cut on the "demolition face" made so as to produce a potential range of possible impact described in Figure one by the Red triangle. The optimal impact footprint is identified by the blue triangle. The height of the stack identifies the limitation of the physical impact (less residual debris scatter).

Potential seismic impacts on critical infrastructure or structures surrounding the impact area are defined in Figure 2 in relations to distances from the impact foot print. In descending order of proximity are:

Figure 2: Distances from Critical Infrastructure for Seismic Affect of Stack Impact



- Active transmission lines (Figure 2 - A): the high tension power lines crossing the Crawford Generating Plant from southwest to northeast are the closest potentially affected infrastructure to the stack impact footprint at a distance of closest approach of approximately 235'.

- Pulaski Highway (Figure 2 - B): although the project impact area of the stack was designed to maximize the distance from Pulaski Road, it remains the second closest infrastructure component at a distance of closest approach of 313'.
- Waste Transfer Station (Figure 2 - C): The Waste Transfer Station (Cougar Avenue) is the third closest infrastructure to the impact area at a distance of approximately 362'.
- Commonwealth Edison Substation (Figure 2 - D): The substation, at the far eastern edge of the CGP property is the fourth closest infrastructure to the stack impact area at approximately 390'.

3.6 Safety

The safety of personnel conducting the demolition is of paramount importance both in the completion of the selected approach as it was in the determination of which approach to employ. As the demolition progresses, the relevant danger increases due to the continued expansion of the relief cut and the unknown point of collapse when the vertical integrity of the structure is compromised by the removal of support.

Nearing this point some basic safety precautions will be employed:

- Reduce or limit personnel working on site
- Operate on "off-peak" hours for surrounding traffic
- Conduct final demolition with only actual demolition technicians present

3.7 Security

The security of the site and limitation of the risk to general public and personnel will be controlled by the MTS contracted on-site security company. J-Team Solutions (owned by Chicago Police Detective Sergeant T. Murphy) will be able to augment with off duty police and coordinate with on-duty police for road closures and site clearance.

3.8 Structural

The stack was constructed with designed apertures at the "transom" level where the exhaust streams from the generating plant processing enter. The two apertures, oriented east and west (Figure 3, next page). The impact of the apertures are assessed in the demolition section of this report. The stack construction is of three layers: external concrete, internal insulation, internal metal flu liner (Figure 4, next page).

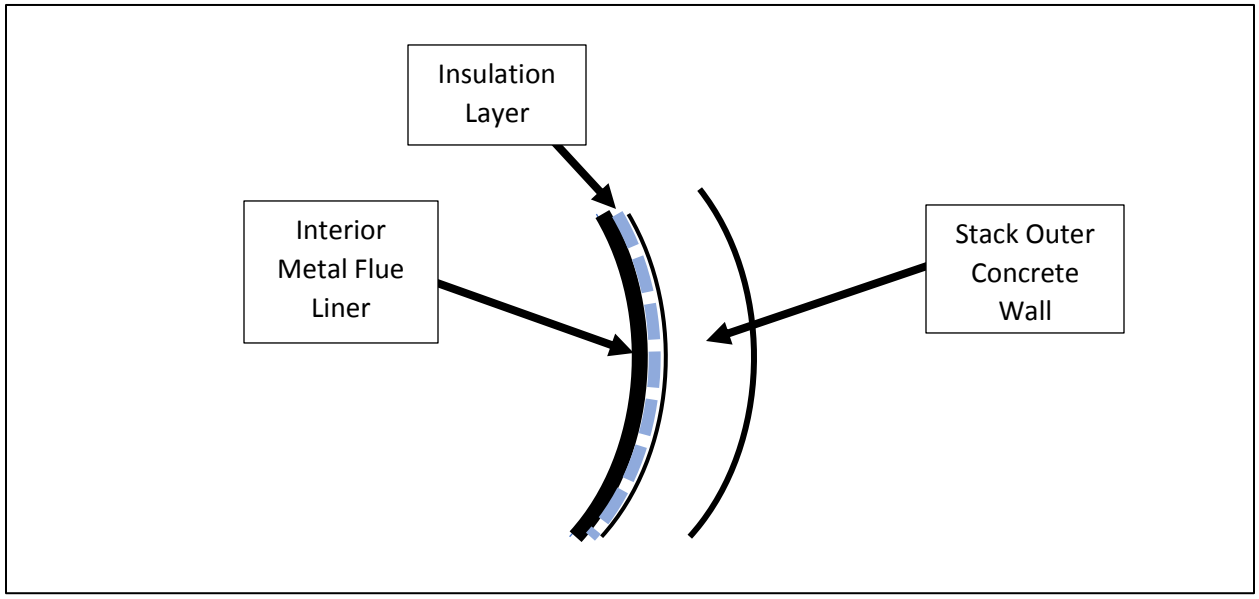
3.9 Condition

The condition of the stack cannot readily be assessed without extensive engineering investigation. Notwithstanding, it is apparent that some level of structural degredation has occurred. From climbing to the top of the stack during light replacment (October 2018), decaying

concrete external shell, corroded steel ladder rungs and brackets and shaling top of stack extensions were clearly visible.

Figure 3: Opposing Transom Openings for Flu into Exhaust Stack

Figure 4: Construction Detail of Stack Walls



The affect of this degradation impacts both the selected approach as well as the methodology and timing of the actual demolition.

3.10 Environmental

There are various environmental elements involved with stack demolition. Each of the three identfied have been given consideration during the evaluation of approach methodology. From the selected metholdolgy the following observations and controls have been compiled.

3.10.1 Noise: The noise of the impact from the selected methodology will be loud but brief. Potential noise load will most probably not exceed 1400-165 Decibals, which is equivalent to firework explosions at a distance of 3' (U.S. Center for Hearing and Communication, Common Environmental Noise Levels, Sonic Boom).

3.10.2 Dust: The stack is constructed of concrete with interior layers of insulation and steel. The dust arrising will only minimally be the product of concrete structural disintegration, but more likely soil impact. For that reason, JEI/MTS recommend attempting to time the reduction and impact immediately after a large precipitation event (preferably in excess of 1"). This will have saturated the soil to a depth of at least four inches and result in the lowest level of dust, other than if accomplished during the winter with the ground frozen or covered with snow. Timing considering wind direction for the reduction will also be employed.

3.10.3 Debris: The debris column of the stack is expected to be minimalistic. The outer concrete shell will crush as the weight collapsed on it. Potential zones of debris release (contained in Figure 5, next page) will primarily be to the sides of the impact zone. The surrounding structures and elevations on both sides of the impact area will assist with controls and the impact footprint was at least partially selected for that reason.

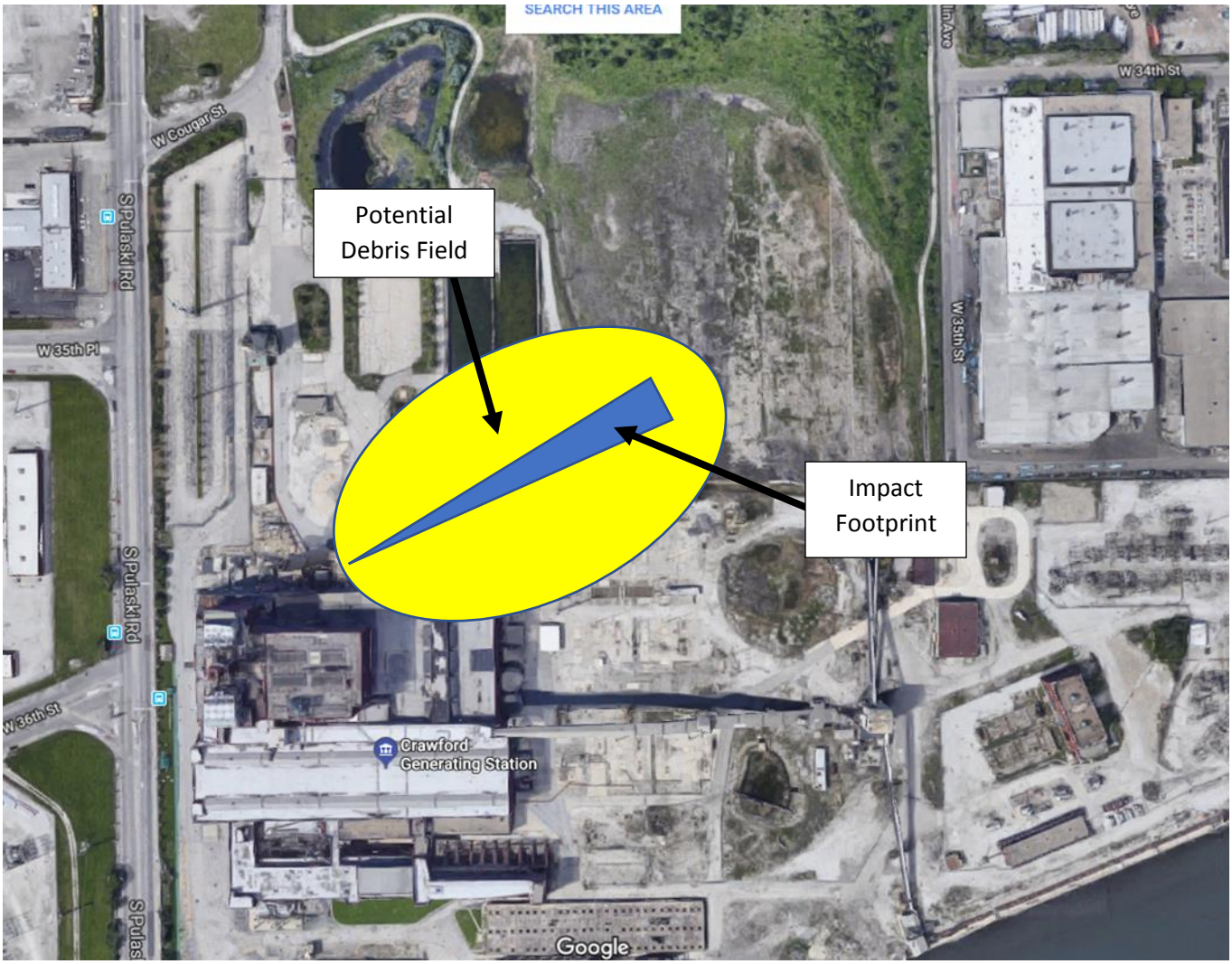
3.11 Timing

Timing of the reduction and the potential impact on the area along with scheduling for off-peak travel time on both Pulaski Road and the nearby freeway (Route 55) will be included in the planning process. It is expected that the ideal reduction timeframe to minimize will be early on either Saturday or Sunday mornings, however, permitting may eliminate such alternatives and mandate weekday demolition.

3.12 Residual

3.12.1 Traffic: Timing will dictate the impact on traffic, but at a minimum a road closure for Pulaski Road will have to be obtained.

Figure 5: Potential Debris Field from Impact Footprint



3.12.2 Populace: There are no residences near enough to the facility to be immediately affected by any potential environmental or residual affects of the impact other than dust. However, again timing of the reduction will be critical to avoid or minimize potential affects on transient or working public surrounding the area.

3.12.3 Public: There is no mechanism for, nor has this evaluation considered, the potential impacts on public perception of this activity.

4.0 Process of Demolition - Mechanical Whole Structure

The demoliton of the structure as a single unit will require preparation up to potential structural failure, then awaiting the optimal time and weather conditions (if such factors are considered significant enough to warrant consideration) to effect the actual reduction (dropping) of the

structure. This summary contains only the initial considerations of the actual process for the demolition.

4.1 Preparation

Preparation includes isolating the stack from the remaining structures, in the event that the stack reduction is not accomplished after all other structures have been removed. This includes removing the exhaust ductwork from above the transformer deck and cutting the grounding and support wires from the base fo the stack.

4.1.1 Transom Removal

The transom-level exhaust ducts, on the east and west side, will be cut free of the stack, if not aleady accomplished during building demoltion, freeing the stack of structural connection to the buildings (Figure 6).

Figure 6: Transom Cuts to Release Stack from Buildings

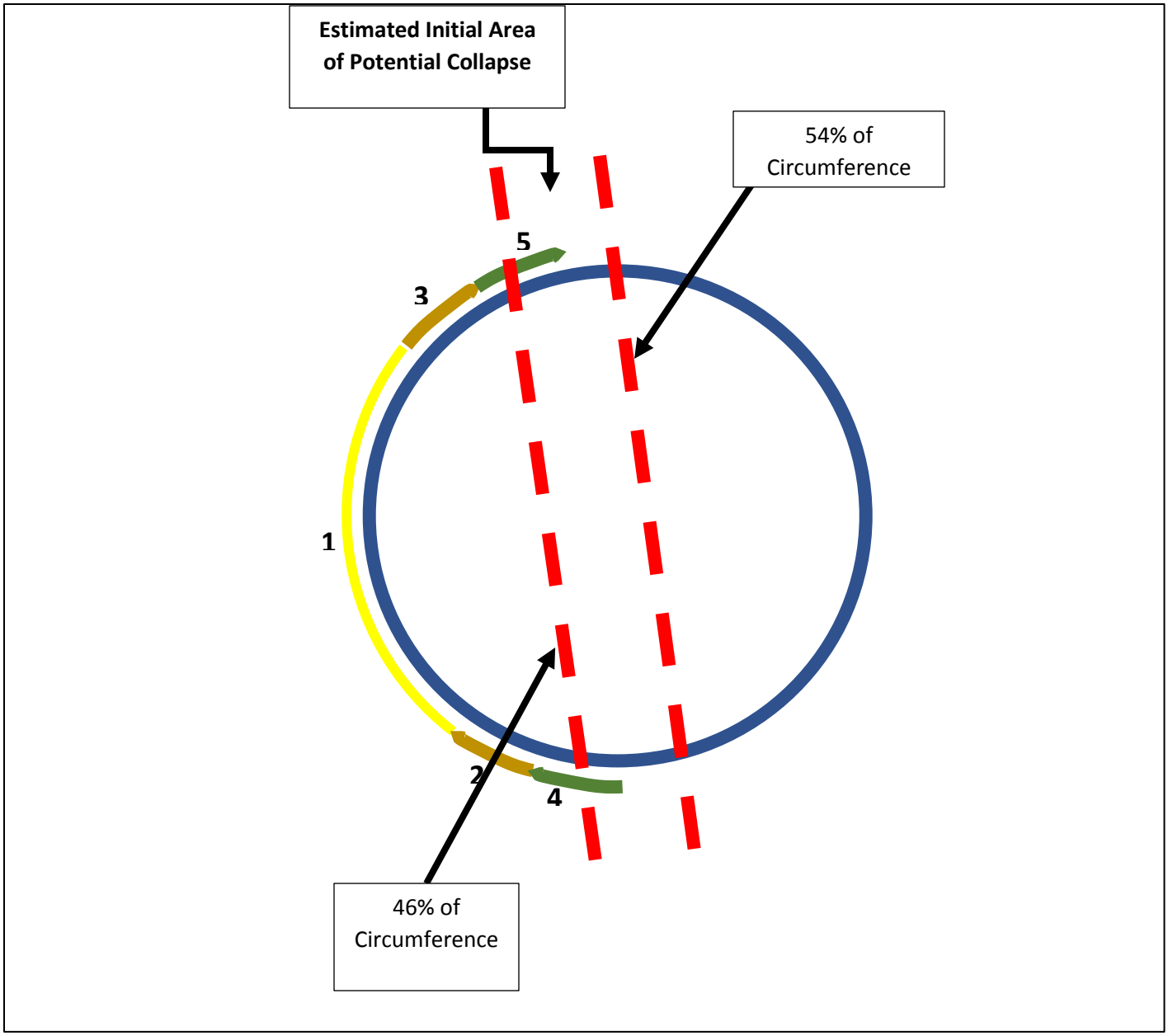
4.1.2 Relief Cut Planning

The planning and execution of the Relief cut installation will determine the direction and success of the stack reduction. The least amount of variance in the installation of the cut, particularly as the cut is extended around the circumference of the stack base is a critical element of performance for the work.

Figures 7 and 8 contain the relief cut outline and the progression and estimated percentage, respectively, of cut work on the stack relative to the pont of critical collapse for the structure.

Figure 7: Relief Cuts Outline

Figure 8: Relief Cut Progression



4.2 Proposed Process

The proposed process, fundamentally communicated in the section above provides for the procession of cuts to be made at the base of the structure allowing the vertical load to impose sufficient pressure and directionally collapse the stack toward the opening created by the relief cuts.

4.2.1 Preparation

Preparing the area for the reduction includes the examination of the stack interior for striations or obvious weakening of the structure at any point in the circumference which would then compromise the intended direactionality of the stack reduction. Additionally, examination of the stack base, ensuring that no degradation of the concrete forming the adhesion to the concrete footer has occurred that would also threaten directionality of the reduction.

4.2.2 Structural Segregation

Structual segregation occurs with the removal of the two flue ducts at the transom level and subsequent cutting of all piping and electrical wire tying the stack to either the base or other structures.

4.3.3 Relief Cut Progression

The relief cut progression is critical, as each piece is removed from the wall of the stack, the structure becomes more unstable. For that reason the cuts made on the side away from the remaining structures are done first so as to ensure movement toward the structurally compromised area and away from the remaining structures (if they are still intact during stack reduction).

A total of five progressional cuts are depicted, however, that number may be increased by reducing the width of each cut (while maintaining even distribution on either side of the initial cut) to allow better control of the reduction process.

5.0 FAA Notification

Once the demolition has reduced the structure to ground level, JEI/MTS will notify the Federal Aviation Adminstration (FAA) to advise them and remove the stack from the "Aeronautical Information Service - Obstacle Data - Structure Types - Stacks (smoke or industrial)".

JEI/MTS will confirm, within 10 days, with the FAA on the website (below) that the stack has been removed as an obstacle from the service and report the confirmation to MCM Management/HilCo Management.

https://www.faa.gov/air_traffic/flight_info/aeronav/obst_data/structuretypes/

6.0 Summary

Further study is needed, however, this preliminary report represents those elements considered most impactful in completing this phase of the demoltion at CGP.